

Appl. No. 10/605,503
Amdt. dated March 23, 2005
Reply to Office action of February 01, 2005

Amendments to the Claims:

This listing of claims will replace all prior versions and listings of claims in the application:

Listing of Claims:

1 (currently amended): A printing apparatus comprising:

- 5 a printhead for ejecting ink from a plurality of sets of nozzles, the printhead comprising:
a substrate; and
a plurality of heaters arranged on the substrate for heating ink in the printhead
to generate bubbles in the ink and eject the ink through corresponding
10 nozzles;
a data transducer for translating raw data into printing data;
a counter for counting a total quantity of printing data value sent to each set of
nozzles;
a memory for storing the total quantity of printing data value corresponding to each
15 set of nozzles; and
a head driver circuit for generating printing signals and non-printing signals
corresponding to each set of nozzles according to the printing data provided by
the data transducer and the total quantity of printing data value stored in the
memory, the printing signals controlling the heaters to generate sufficient heat
20 energy to eject ink from the nozzles for printing data, and the non-printing
signals controlling the heaters to generate heat energy that is not sufficient to
eject ink from the nozzles for raising a temperature of the ink, the head driver
circuit comprising:
a signal generator for generating a plurality of printing signals and non-printing
25 signals having unique energy values;
a comparator for comparing the total quantity of printing data value stored in
the memory with a plurality of reference values; and

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a selector circuit for selecting printing and non-printing signals generated by the signal generator to be sent to the corresponding set of nozzles based on the comparison results given by the comparator.

- 5 2 (original): The printing apparatus of claim 1 wherein each set of nozzles consists of a single nozzle.
- 3 (original): The printing apparatus of claim 1 wherein each set of nozzles consists of a plurality of nozzles.
- 10 4 (original): The printing apparatus of claim 3 wherein the plurality of nozzles in each set of nozzles are located adjacent to each other.
- 5 (canceled).
- 15 6 (original): The printing apparatus of claim 1 wherein the counter increases the total quantity of printing data value corresponding to each set of nozzles for each printing signal sent to the set of nozzles.
- 20 7 (original): The printing apparatus of claim 1 wherein the total quantity of printing data value corresponding to each set of nozzles is kept constant for each printing signal sent to the set of nozzles if the total quantity of printing data value is greater than a predetermined threshold value.
- 25 8 (original): The printing apparatus of claim 1 wherein the counter decreases the total quantity of printing data value corresponding to each set of nozzles for each non-printing signal sent to the set of nozzles.

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9 (original): The printing apparatus of claim 1 wherein the total quantity of printing data value corresponding to each set of nozzles is reset if no printing signal is sent to the set of nozzles during a predetermined period of time.

5 10 (currently amended): A method for heating a printhead in a printing apparatus, the printing apparatus comprising:

a printhead for ejecting ink from a plurality of sets of nozzles, the printhead comprising:

a substrate; and

10 a plurality of heaters arranged on the substrate for heating ink in the printhead to generate bubbles in the ink and eject the ink through corresponding nozzles; and

a data transducer for translating raw data into printing data;

the method comprising:

15 counting a total quantity of printing data value sent to each set of nozzles;
storing the total quantity of printing data value corresponding to each set of nozzles in a memory;

generating a plurality of printing signals and non-printing signals having unique energy values;

20 comparing the total quantity of printing data value stored in the memory with a plurality of reference values; and

selecting printing and non-printing signals to be sent to the corresponding set of nozzles based on the comparison results.

and

25 ~~generating printing signals and non-printing signals corresponding to each set of nozzles according to the printing data provided by the data transducer and the total quantity of printing data value stored in the memory, the printing signals controlling the heaters to generate sufficient heat energy to~~

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~~eject ink from the nozzles for printing data, and the non-printing signals
controlling the heaters to generate heat energy that is not sufficient to eject
ink from the nozzles for raising a temperature of the ink.~~

5 11 (original): The method of claim 10 wherein each set of nozzles consists of a single nozzle.

12 (original): The method of claim 10 wherein each set of nozzles consists of a plurality of nozzles.

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13 (original): The method of claim 12 wherein the plurality of nozzles in each set of nozzles are adjacent to each other.

14 (canceled).

15

15 (original): The method of claim 10 further comprising increasing the total quantity of printing data value corresponding to each set of nozzles for each printing signal sent to the set of nozzles.

20 16 (original): The method of claim 10 further comprising keeping the total quantity of printing data value corresponding to each set of nozzles constant for each printing signal sent to the set of nozzles if the total quantity of printing data value is greater than a predetermined threshold value.

25 17 (original): The method of claim 10 further comprising decreasing the total quantity of printing data value corresponding to each set of nozzles for each non-printing signal sent to the set of nozzles.

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- 18 (original): The method of claim 10 further comprising resetting the total quantity of printing data value corresponding to each set of nozzles if no printing signal is sent to the set of nozzles during a predetermined period of time.
- 5 19 (new): A printing apparatus comprising:
- a printhead for ejecting ink from a plurality of sets of nozzles, each set of nozzles consisting of a plurality of nozzles, the printhead comprising:
 - a substrate; and
 - a plurality of heaters arranged on the substrate for heating ink in the printhead
 - 10 to generate bubbles in the ink and eject the ink through corresponding nozzles;
 - a data transducer for translating raw data into printing data;
 - a counter for counting a total quantity of printing data value sent to each set of nozzles;
 - 15 a memory for storing the total quantity of printing data value corresponding to each set of nozzles; and
 - a head driver circuit for generating printing signals and non-printing signals corresponding to each set of nozzles according to the printing data provided by the data transducer and the total quantity of printing data value stored in the
 - 20 memory, the printing signals controlling the heaters to generate sufficient heat energy to eject ink from the nozzles for printing data, and the non-printing signals controlling the heaters to generate heat energy that is not sufficient to eject ink from the nozzles for raising a temperature of the ink.
- 25 20 (new): A printing apparatus comprising:
- a printhead for ejecting ink from a plurality of sets of nozzles, the printhead comprising:
 - a substrate; and

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- a plurality of heaters arranged on the substrate for heating ink in the printhead to generate bubbles in the ink and eject the ink through corresponding nozzles;
- a data transducer for translating raw data into printing data;
- 5 a counter for counting a total quantity of printing data value sent to each set of nozzles, wherein the total quantity of printing data value corresponding to each set of nozzles is kept constant for each printing signal sent to the set of nozzles if the total quantity of printing data value is greater than a predetermined threshold value;
- 10 a memory for storing the total quantity of printing data value corresponding to each set of nozzles; and
- a head driver circuit for generating printing signals and non-printing signals corresponding to each set of nozzles according to the printing data provided by the data transducer and the total quantity of printing data value stored in the
- 15 memory, the printing signals controlling the heaters to generate sufficient heat energy to eject ink from the nozzles for printing data, and the non-printing signals controlling the heaters to generate heat energy that is not sufficient to eject ink from the nozzles for raising a temperature of the ink.
- 20 21 (new): A printing apparatus comprising:
- a printhead for ejecting ink from a plurality of sets of nozzles, the printhead comprising:
- a substrate; and
- a plurality of heaters arranged on the substrate for heating ink in the printhead
- 25 to generate bubbles in the ink and eject the ink through corresponding nozzles;
- a data transducer for translating raw data into printing data;
- a counter for counting a total quantity of printing data value sent to each set of

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- nozzles, wherein the counter decreases the total quantity of printing data value corresponding to each set of nozzles for each non-printing signal sent to the set of nozzles;
- 5 a memory for storing the total quantity of printing data value corresponding to each set of nozzles; and
- a head driver circuit for generating printing signals and non-printing signals corresponding to each set of nozzles according to the printing data provided by the data transducer and the total quantity of printing data value stored in the memory, the printing signals controlling the heaters to generate sufficient heat energy to eject ink from the nozzles for printing data, and the non-printing signals controlling the heaters to generate heat energy that is not sufficient to eject ink from the nozzles for raising a temperature of the ink.
- 10
- 22 (new): A method for heating a printhead in a printing apparatus, the printing apparatus comprising:
- 15 a printhead for ejecting ink from a plurality of sets of nozzles, each set of nozzles consisting of a plurality of nozzles, the printhead comprising:
- a substrate; and
- a plurality of heaters arranged on the substrate for heating ink in the printhead to generate bubbles in the ink and eject the ink through corresponding nozzles; and
- 20 a data transducer for translating raw data into printing data;
- the method comprising:
- counting a total quantity of printing data value sent to each set of nozzles;
- 25 storing the total quantity of printing data value corresponding to each set of nozzles in a memory; and
- generating printing signals and non-printing signals corresponding to each set of nozzles according to the printing data provided by the data transducer

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5 and the total quantity of printing data value stored in the memory, the printing signals controlling the heaters to generate sufficient heat energy to eject ink from the nozzles for printing data, and the non-printing signals controlling the heaters to generate heat energy that is not sufficient to eject ink from the nozzles for raising a temperature of the ink.

23 (new): A method for heating a printhead in a printing apparatus, the printing apparatus comprising:

10 a printhead for ejecting ink from a plurality of sets of nozzles, the printhead comprising:
a substrate; and
a plurality of heaters arranged on the substrate for heating ink in the printhead to generate bubbles in the ink and eject the ink through corresponding nozzles; and

15 a data transducer for translating raw data into printing data;

the method comprising:

counting a total quantity of printing data value sent to each set of nozzles;
keeping the total quantity of printing data value corresponding to each set of nozzles constant for each printing signal sent to the set of nozzles if the
20 total quantity of printing data value is greater than a predetermined threshold value;
storing the total quantity of printing data value corresponding to each set of nozzles in a memory; and
generating printing signals and non-printing signals corresponding to each set
25 of nozzles according to the printing data provided by the data transducer and the total quantity of printing data value stored in the memory, the printing signals controlling the heaters to generate sufficient heat energy to eject ink from the nozzles for printing data, and the non-printing signals

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controlling the heaters to generate heat energy that is not sufficient to eject ink from the nozzles for raising a temperature of the ink.

- 24 (new): A method for heating a printhead in a printing apparatus, the printing apparatus
5 comprising:
a printhead for ejecting ink from a plurality of sets of nozzles, the printhead comprising:
a substrate; and
a plurality of heaters arranged on the substrate for heating ink in the
10 printhead to generate bubbles in the ink and eject the ink through corresponding nozzles; and
a data transducer for translating raw data into printing data;
the method comprising:
counting a total quantity of printing data value sent to each set of nozzles;
15 decreasing the total quantity of printing data value corresponding to each set of nozzles for each non-printing signal sent to the set of nozzles;
storing the total quantity of printing data value corresponding to each set of nozzles in a memory; and
generating printing signals and non-printing signals corresponding to each set
20 of nozzles according to the printing data provided by the data transducer and the total quantity of printing data value stored in the memory, the printing signals controlling the heaters to generate sufficient heat energy to eject ink from the nozzles for printing data, and the non-printing signals controlling the heaters to generate heat energy that is not sufficient to eject
25 ink from the nozzles for raising a temperature of the ink.